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DRAWINGS ATTACHED

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(54) LOW TEMPERATURE GAS MIXTURE SEPARATION PROCESS

(71) We, THE BRITISH OXYGEN COMPANY LIMITED, of Hammersmith House, London W.6., England, a British Company,

do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:—

This invention relates to gas mixture separation and more particularly to the separation of a hydrogen fraction and a carbon monoxide fraction from a complex gas mixture containing these two gases and other constituents such as carbon dioxide and hydrocarbons.

Such complex gas mixtures are obtained for example by steam reforming of feedstock such as natural gas or naphtha.

In certain synthesis processes, particularly the OXO process, it is necessary to separate the complex gas mixtures into a carbon monoxide fraction and a hydrogen fraction substantially free from other components except methane, which can be tolerated up to a maximum of about 1.5%.

According to this invention a process for separating a complex gas mixture containing hydrogen, carbon oxide compounds and methane together with small amounts of higher hydrocarbons and other impurities such as water vapour, comprises subjecting the gas mixture to a pre-purification process to remove carbon dioxide and water vapour, separating the purified gas mixture by cryogenic rectification and condensation to produce a hydrocarbon fraction, a carbon monoxide fraction and a hydrogen fraction containing about 2.5 to 5 per cent residual carbon monoxide, removing the residual carbon monoxide from the hydrogen fraction by methanation to produce a hydrogen stream containing methane substantially equivalent to the residual carbon monoxide content of the hydrogen fraction and reducing the methane content of the hydrogen stream by cryogenic separation.

The residual methane content of the hydrogen product stream is determined by the use to which the hydrogen is put and the cryogenic separation process will, in general be so controlled as to remove the minimum quantity of methane necessary. The carbon monoxide fraction may contain some hydrogen and residual methane.

The accompanying drawing shows diagrammatically the essential stages of a gas separation process for producing the synthesis gases required for the OXO process.

Naphtha or other feed gas is fed to a steam reformer 1 in which is produced a gas mixture containing hydrogen and carbon monoxide together with carbon dioxide, water vapour, methane and minor amounts of other hydrocarbons.

The mixture is then passed through a scrubber 2 to remove CO_2 and then through an adsorbent bed (not shown) to remove water and residual traces of CO_2. Thus pre-purified the gas mixture is subjected to cryogenic separation in a rectification and condensation unit 3 of a conventional type, the separation products of such unit being a methane fraction, a carbon monoxide fraction and a hydrogen fraction containing a residual amount of carbon monoxide. In the specific case illustrated, the residual carbon monoxide content is 2.8%.

The hydrogen fraction is then passed to a methanator 4 where the carbon monoxide is converted to methane, the emergent hydrogen stream containing 3.1% methane. The methane content of this stream is then reduced by cryogenic separation in the unit 3 to produce a final hydrogen product having a methane content of 1.5%. Hydrogen having a methane content of this level is acceptable as one of the synthesis gases for the OXO process. It is difficult to obtain a methane content of less than 1.5% merely by cryogenic separation. If the use to which the hydrogen fraction is to be put demands a lower methane content, it is necessary to remove the methane by adsorption techniques.

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WHAT WE CLAIM IS:—

1. A process for separating a complex gas mixture containing hydrogen, carbon oxide compounds and methane together with small amounts of higher hydrocarbons and other impurities such as water vapour, comprising subjecting the gas mixture to a pre-purification process to remove carbon dioxide and water vapour, separating the purified gas mixture cryogenic rectification and condensation to produce a hydrocarbon fraction, a carbon monoxide fraction and a hydrogen fraction containing about 2.5 to 5% residual carbon monoxide, removing the residual carbon monoxide from the hydrogen fraction by methanation to produce a hydrogen stream containing methane substantially equivalent to the residual carbon monoxide content of the hydrogen fraction and reducing the methane content of the hydrogen stream by cryogenic separation.

2. A process as claimed in Claim 1 wherein the cryogenic separation of the hydrogen stream is effective to reduce the methane content to at least 1.5%.

3. A process for separating a complex gas mixture containing hydrogen, carbon oxide compounds and methane together with small amounts of higher hydrocarbons and other impurities such as water vapour substantially as herein described with reference to the accompanying drawing.

For the Applicants,
F. W. B. KITTEL,
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1217706 COMPLETE SPECIFICATION
1 SHEET *This drawing is a reproduction of the Original on a reduced scale*